Space Weather Technical Forecast

Issued on Friday, 08 April 2022 at 13:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/Minor Geomagnetic Storms, mainly Day 3 (10th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours. Four sunspot regions remain on the visible disc. AR2978 (Cho/Beta), in the southwest, is the largest region on the disc and continues to show signs of decay, losing its intermediate spots and it has remained relatively stable with no noteworthy activity. AR2981 has decayed and has lost the spots in its trailing group. It is now classified Axx/alpha. AR2985 has simplified and is now classified Cri/Beta. There is also a new region in the northwest quadrant with some recent development in the trailing spots Cro/Beta.
No Earth-directed CMEs have occurred in the last 24 hours, although there are a number of filaments visible on the Earth-facing disc that are being monitored for any potential eruption.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, started the period at slightly elevated levels becoming Low by the end of Thursday, reaching a peak of 422 km/s at 07/1320 UTC. The solar wind density was mostly near Average becoming above average for a time with a peak noted of 17 ppcc at 08/0510 UTC. The interplanetary magnetic field (IMF) strength, Bt, started weak, below 8nT, becoming Moderate at 08/0340 UTC and peaking at 11 nT at 08/0559 UTC with a slow decline observed thereafter. The north-south component ranged between -7 and +6 nT, with some prolonged negative spells (southward) direction until 08/0300 UTC when it turned positive. The Phi angle was mostly rather indeterminate in orientation starting the period negative (towards the Sun). Geomagnetic activity was Quiet to Active (Kp1- 4).
Energetic Particles / Solar Radiation: The high energy proton flux (10MeV) measured at GOES-16 at GEO was at background levels. The high energy (greater than 2MeV) electron flux was at Moderate to High levels, with a peak of 3210 pfu at 07/1330 and 07/1415 UTC before becoming mostly normal background by the start of Friday. The 24-hour corresponding fluence gradually declined, falling below the Active threshold (1e8 integrated pfu) at 07/2100 UTC. 7.79e7 integrated pfu was observed at 08/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be predominantly Very Low, with only relatively small and simple sunspot regions currently on the disc. There remains a 40% risk of C-class flares raising solar activity to Low.

Solar Wind / Geomagnetic Activity: Solar winds are likely to remain mostly slow-ambient with little change likely until Day 2 (9th April), when there is a slight chance of a glancing interaction from a CME which left the Sun around 04/2200 UTC, although this is very low confidence. Weak coronal hole influence from CH72 is also expected to arrive through the forecast period, most likely during day 3 (10th) and persisting through Day 4 (11th). Geomagnetic activity is forecast to

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be generally Quiet to Unsettled (Kp1-3) throughout, becoming Active (Kp4) at times from Day 2 (9th April), with a 20-40% chance of Minor geomagnetic Storms (Kp5), with the highest risk on Day 3 (10 April).

Energetic Particles / Solar Radiation: The high energy (greater than 10MeV) proton flux is expected to persist at background levels. The high energy (greater than 2 MeV) electron flux is now unlikely to breach the High threshold until Day 2 (10 April) at the earliest and for much of the forecast period the flux is expected to be at Background to Moderate levels. On Day 4 (11th April), the flux may again breach the High threshold. The associated 24 hour fluence has fallen below the Active (1e8 integrated pfu) threshold and is expected to remain below through the forecast period, although with a rising trend through day 4 (11th April).

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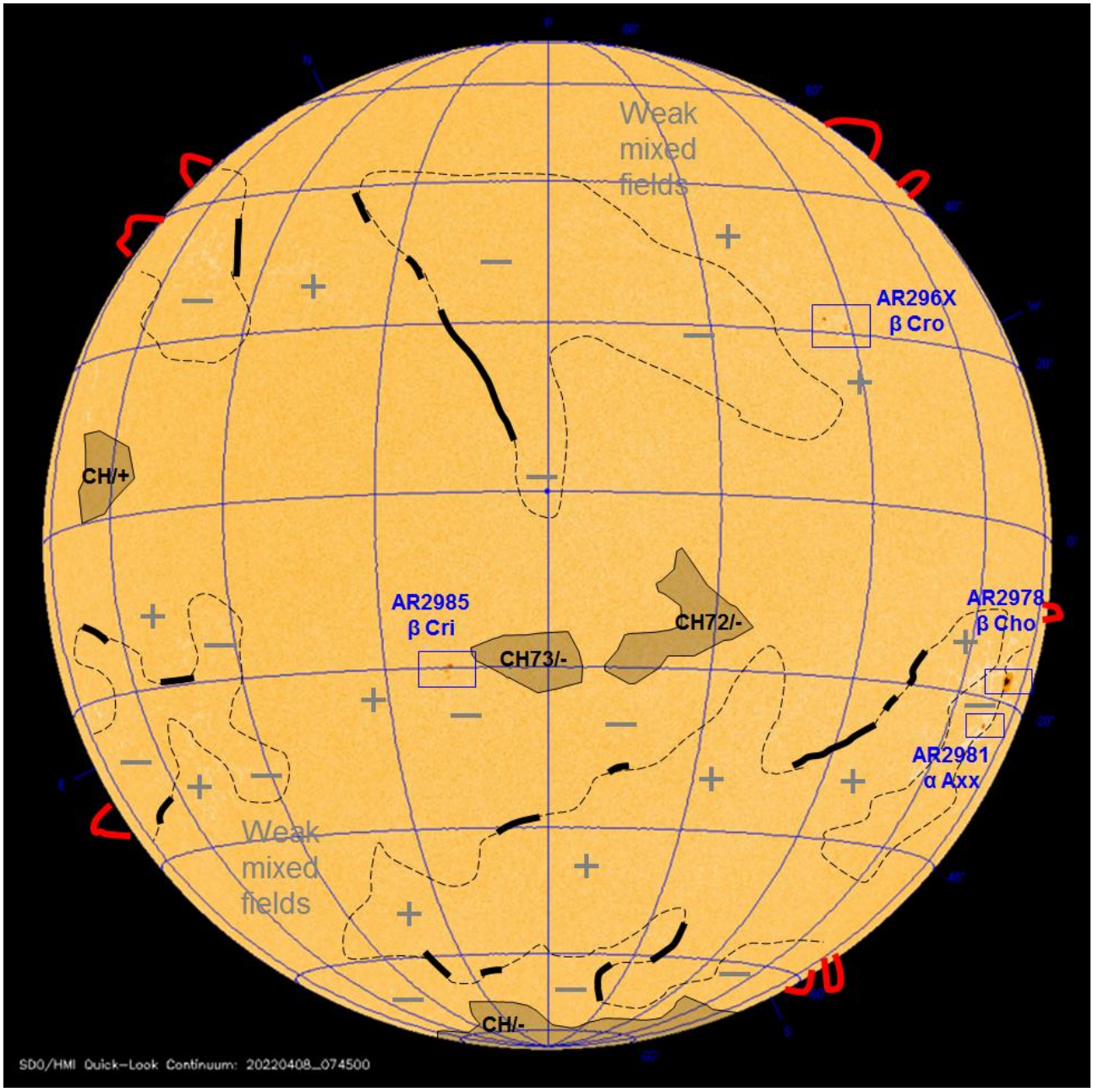
Figure 1. Solar Analysis Valid 0800UTC, 8 April 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

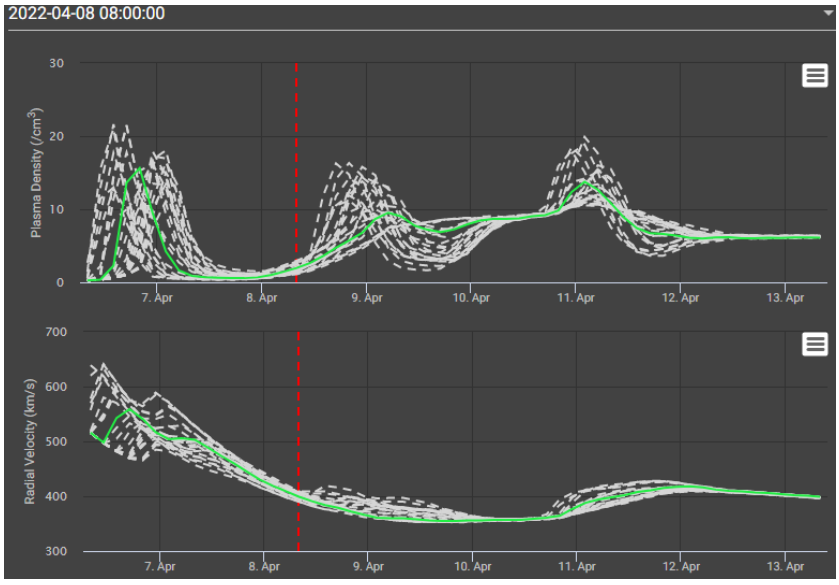
The next coronal hole enhancement is anticipated to arrive during sometime on day 3 (10th), from CH72/-. The solar wind is likely to become slightly elevated levels, with a chance of the solar wind becoming elevated later day 3 into day 4 (11th).
A CME which had been assessed as potentially arriving on day 3 (9th) has now been reassessed as likely missing, passing mostly to the south and east of the Earth. There remains uncertainty with this analysis however, and a glancing interaction cannot be ruled out later today (8th) and into day 3 (9th).
Geomagnetic activity is forecast to be Quiet to Unsettled (Kp 1-3) becoming Active (Kp4) at times from Day 2 (9 April). There is a slight chance of a G1/Minor Storm interval (Kp 5) occurring if the CME arrives, and a chance of a G1/Minor geomagnetic storm during the CIR and initial onset of the high speed stream during day 3 (10 April).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	40	20
Strong	G3	No	1	1	5	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Met Office ENLIL ensemble indicating most likely arrival times for recent CMEs.



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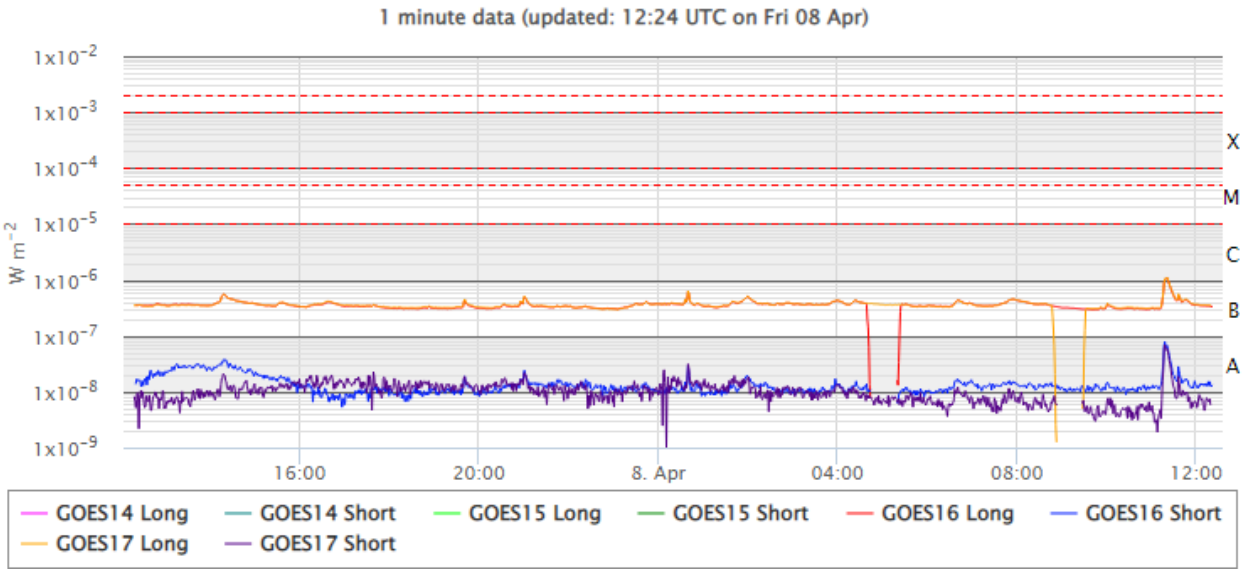
Radio Blackouts - X-Ray Flares:
There are three numbered sunspot regions on the visible disc: AR2978 in the southwest quadrant remains the visibly largest region on the disc, and continues to gradually decay, with the previous intermediate spots disappearing. It appears to be relatively stable and has produced no noteworthy activity recently. AR2981 to the south of this region, has lost many of its trailing spots, is now a simple Axx/alpha and is close to disappearing. AR2985 in the southeast has also simplified, and is now a Cri/beta. There is also a small, simple new region emerging in the northwest quadrant which and classified Cro/Beta.
Solar activity is expected to remain Low or Very Low and AR2978 is the most likely source of any activity, and therefore the risk reduces later in the period as this region rotates round the western limb. Currently no significant sunspots are expected to rotate onto the visible disc from the farside.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	5	2	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux at GEO showing very little activity over past 24 hours.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background levels. It is expected to remain at this level during the forecast period, but there is a very slight risk of proton storms as AR2978 (currently the most complex sunspot region on the visible disc) rotates across the southwestern limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV), as observed by GOES-16 at GEO, has declined to Normal Background levels and is expected to persist at similar levels through much of the period. However, the flux may briefly exceed the High threshold (1000 pfu) at the peak of the diurnal cycle during day 4 (11th) as a result of weak coronal hole influence from CH72 enhancing the solar wind.

The associated 24 hour fluence has fallen below the Active (1e8 integrated pfu) threshold and is likely to remain below through the forecast period, although with a rising trend probable through day 4 (11th). The Met Office REFM output is therefore currently considered to be giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	20	20	10	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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